

09/390,051

|   | Type | L # | Hits   | Search Text                              | DBs  | Time Stamp          |
|---|------|-----|--------|--|--|---------------------|
| 1 | BRS  | L1  | 85551  | malfunction or (hardware<br>adj failure) | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:21 |
| 2 | BRS  | L2  | 171451 | aircraft or aerospace                    | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:21 |
| 3 | BRS  | L3  | 27246  | display near ( color or<br>colour)       | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:22 |

|   | Type | L # | Hits | Search Text  | DBs  | Time Stamp          |
|---|------|-----|------|--|--|---------------------|
| 4 | BRS  | L4  | 438  | identical adj (processors<br>or controllers or CPUs) | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:23 |
| 5 | BRS  | L5  | 123  | redundancy adj management                            | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:23 |
| 6 | BRS  | L6  | 0    | 1 and 2 and 4 and 5                                  | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:24 |

|   | Type | L # | Hits | Search Text   | DBs  | Time Stamp          |
|---|------|-----|------|---------------|--|---------------------|
| 7 | BRS  | L7  | 2    | 1 and 4 and 5 | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:26 |
| 8 | BRS  | L9  | 0    | 1 and 4 and 8 | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:26 |
| 9 | BRS  | L10 | 0    | 1 and 3 and 8 | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:26 |

|    | Type | L # | Hits  | Search Text                 | DBs  | Time Stamp          |
|----|------|-----|-------|-----------------------------|--|---------------------|
| 10 | BRS  | L11 | 0     | 5 and 8                     | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:26 |
| 11 | BRS  | L8  | 108   | 345/618.ccls.               | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:31 |
| 12 | BRS  | L12 | 32151 | color near (change or vary) | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:32 |

|    | Type | L # | Hits | Search Text             | DBs  | Time Stamp          |
|----|------|-----|------|-------------------------|--|---------------------|
| 13 | BRS  | L13 | 0    | 1 and 12 and 8          | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:32 |
| 14 | BRS  | L14 | 4    | "fault-tolerant" and 12 | USPAT;<br>US-PGP<br>UB;<br>EPO;<br>JPO;<br>DERWEN<br>T; IBM<br>TDB | 2002/01/15<br>12:38 |

# United States Patent

Sprole, Jr. et al.

[19]



US005812102A

Patent Number: 5,812,102

Date of Patent: Sep. 22, 1998

[54] VITAL MONITORING SYSTEM FOR SEVEN-SEGMENT DISPLAY USED IN RAILROAD APPLICATIONS

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[73] Assignee: Union Switch & Signal Inc., Pittsburgh, Pa.

[21] Appl. No.: 815,249

[22] Filed: Mar. 12, 1997

[51] Int. Cl.<sup>6</sup> G06F 3/14

[52] U.S. Cl. 345/34; 345/46; 345/117

[58] Field of Search 345/32-54, 117, 345/207, 340/815.44

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## ABSTRACT

A system and method of monitoring light emitted from a light emitting diode (LED) display device, which typically has a plurality of selectively energizable display segments which are grouped to form desired shapes and/or alphanumeric characters, is provided, particularly for use in an Aspect Display Unit (ADU) that requires vitality when utilized in the railroad industry as a component of an Automatic Train Protection system utilized in the railroad industry. In a preferred embodiment, each particular segment of the LED display device is independently monitored by an accompanying independent dual photo-transistor circuit when a non-vital output periodically drives each segment to a known electrical state and then back to the original state. A first and a second photo-transistor is used for each segment of the LED display. Each segment and the accompanying first and second phototransistor is surrounded by a shield which prevents light from other segments from being detected by the particular first and second photo-transistor. The first photo-transistor is directed toward the particular segment to sense light emitted therefrom and ambient light thereabout, while the second photo-transistor is directed away from the particular segment sense only ambient light thereabout that segment. The first and second phototransistors generate electrical signals which are representative of the light detected by each of the first and second photo-transistors. The generated electrical signals drive a monitoring circuit which generates error signals representative of malfunctioning LED display segments based on a comparison to a fixed voltage of a difference in voltages provided from the first and second photo-transistors.

20 Claims, 5 Drawing Sheets

